

iGEM 2016 – Microbiology – BMB – SDU

Project type: Bacteriocin Project title: IMPACT (Intein Mediated Purification with an Affinity Chitin-binding Tag) Sub project: Purify hybrid-bacteriocin Lacticin Q-Lacticin Z <i>E. coli</i> :ER2566	Creation date: 2016.09.29 Written by: Brian Kenn Baltzar Performed by: Brian Kenn Baltzar & Cathrine Høyer Christensen
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1. SOPs in use.

SOP0007_v01 LA plates with antibiotic

SOP0022_v01 Competent cell - freeze-stock

SOP0023_v01 Ca⁺⁺ transformation.

Plasmid purification kit

SOP0001_v01 ON culture of *E.coli*

SOP0004_v01 Bacterial freeze stock

SOP0017_v01 Fast digest

SOP0015_v01 Ligation

Gel purification kit

SOP0021_v01 Colony PCR with MyTaq

SOP0010 - Phusion PCR

SOP0009_v01 TSB transformation

SOP0028_v01 - Bradford Protein Concentration determination

SOP0025_v01 - Impact_Purification

SOP0027_v01 - MIC

2. Purpose.

To purify the hybrid-bacteriocin Lacticin Q-Lacticin Z *E. coli*:ER2566 and determine microbial effect.

3. Overview.

Day	SOPs	Experiments
1		Design primers with restriction sites for NdeI and SapI
2	SOP0010	Phusion PCR to give gene the correct restriction sites
2		Gel Electrophoresis to test if PCR were successful
2	Fermentas GeneJET Gel Extraction Kit	Purify pPCR product
3	SOP0025_v01	Impact purification, step. 8.1.1 → 8.1.4
4	SOP0021_v01	colony PCR to see which ligations were correct
4	SOP0025_v01	Impact purification, step. 8.1.5
5	SOP0025_v01	Impact purification, step. 8.1.6
6	SOP0025_v01	Impact purification, step. 8.1.7 → 8.1.8
7	SOP0025_v01	Impact purification, step. 8.2.1
8	SOP0025_v01	Impact purification, step. 8.2.2 → 8.2.3
9	SOP0025_v01	Impact purification, step. 8.2.4 → 8.3.9
10	SOP0025_v01	Impact purification, step. 8.4.1 → 8.4.2
10	SOP0028_v01	Bradford Protein Concentration Determination
10	SOP0025_v01	Impact purification, step. 8.4.3
11	SOP0027_v01	Determination of effect with MIC test.

4. Materials required.

Materials in use

Name	Components (Concentrations)	Manufacturer / Cat. #	Room	Safety considerations
Appropriate medium ex. LB	1% Tryptone 1% NaCl 0.5% Yeast extract	Oxoid Sigma-Aldrich Merck	Media lab or V18-405-0	
Glycerol	50 %	AppliChem	Anne Mette, RT	

LB		Anne-Mette		
LA	1% Tryptone 1% NaCl 0.5% Yeast extract 1.5% agar	Oxoid Sigma-Aldrich Merck Difco agar from BD	Anne-Mette Or V18-405-0	
Water	Demineralised milli-Q autoclaved water	Milli-Q water purification system (Millipore)	RT	Water
MyTaq™HS Red Mix	http://www.bioline.com/documents/product_inserts/MyTaq%E2%84%A2%20HS%20Red%20Mix.pdf#zoom=130	Bioline	V18-405a-2	
Reverse primer	Made specific to the template	Sigma-Aldrich		
Forward primer	Made specific to the template	Sigma-Aldrich		
Ligasebuffer		Agilent Technologies	Freezer at 1. Floor	
Ligase			Freezer 1. Floor	Ligase
FastDigest enzyme		Agilent Technologies	Freezer at 1. Floor	
Fast digest green / 10 x FastDigest Buffer		Agilent Technologies	Freezer at 1.	
CaCl ₂	0.1M		Chem room	
MgCl ₂	0.1M		Chem room	MgCl ₂
liquid nitrogen	liquid nitrogen	liquid nitrogen	liquid nitrogen	
Fast digest green		Agilent Technologies	Freezer at 1.	
6x DNA Loading Dye		GeneRuler	fridge floor 1	
Fort. LB		the new Anne-Mette	Autoclave room	

Polyethylen e glycol (PEG) 3.350		Sigma Aldrich	Micro Chemic al room
Dimethylsul foxid (DMSO)		Sigma Aldrich	Micro Chemic al room
Magnesium chloride (MgCl ₂) 1M	1M	The New Anne-Mette	Autocla ve
Microtiter plates			Chem Room
Tris-base			Chem Room
dH ₂ O			Chem Room
Tris-HCl 1M			Chem Room
NaCl 5M			Chem Room
EDTA 0,5M			Chem Room
Tween 20			Chem Room
DTT 1M			Chem Room
Bio-Rad Filter Columns			Chem Room
Bio-Rad Econo-Pac 10DG columns			Chem Room
Chitin Beads			Chem Room
Bio-Rad protein Assay solution			Special Buy
BSA 1 mg/ml			Chem Room

5. Other

As competent cells, LB and LA media was used by all parts of our project and not just this protocol the dates for use of these SOPs are not added. This comment deal with SOP number: SOP0007_v01 and SOP0022_v01

Gel Electrophoresis is set at 75 V for 30-45 minutes, dependent on the gel percentages.

6. Experiment history.

Date (YY.MM.DD)	SOPs	Alterations to SOPs and remarks to experiments																					
16.08.25	SOP0010_v01	<p>Phusion PCR (pPCR) using designed primers with NdeI and SapI restriction sites. Total Volume: 50 µl</p> <p>Following program was used:</p> <table> <tr> <th>Cycle</th><th>°C</th><th>Time (min)</th></tr> <tr> <td>Initial denature</td><td>98</td><td>00:30</td></tr> <tr> <td>Denature</td><td>98</td><td>00:05</td></tr> <tr> <td>Anneal</td><td>69</td><td>00:20</td></tr> <tr> <td>Extention</td><td>72</td><td>00:15</td></tr> <tr> <td>Final extention</td><td>70</td><td>10:00</td></tr> <tr> <td>Hold</td><td>4</td><td></td></tr> </table>	Cycle	°C	Time (min)	Initial denature	98	00:30	Denature	98	00:05	Anneal	69	00:20	Extention	72	00:15	Final extention	70	10:00	Hold	4	
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Final extention	70	10:00																					
Hold	4																						
16.08.25	Gel Electrophoresis	To see if pPCR was successful																					
16.08.25	Plasmid purification	Plasmid purification of pTXB1 our vector.																					
16.08.29	Gel purification	The pPCR product is purified using Fermentas GeneJET Gel Extraction Kit																					
16.08.29	SOP0025_v01	<p>Impact_Purification step. 8.1.1</p> <table> <tr> <td></td><td>Insert (purified pPCR product)</td><td>pTXB1(Vector)</td></tr> <tr> <td>H2O</td><td>15.5µl</td><td>9.5µl</td></tr> </table>		Insert (purified pPCR product)	pTXB1(Vector)	H2O	15.5µl	9.5µl															
	Insert (purified pPCR product)	pTXB1(Vector)																					
H2O	15.5µl	9.5µl																					

	Buffer	2µl	2µl
	DNA	10µl	5µl
	NdeI	1.5µl	1.5µl
	SapI	1µl	1µl
	FastAP	---	1µl
The reaction stood for 7 hours at 37°C			

16.08.29 SOP0025_v01 Impact_Purification step. 8.1.3 → 8.1.4

16.08.31 SOP0025_v01 Impact_Purification step. 8.1.5

16.09.02 SOP0025_v01 Impact_Purification step. 8.1.6 → 8.1.8

16.09.03 SOP0025_v01 Impact_Purification step. 8.1.9

16.09.21 SOP0025_v01 Impact_Purification step. 8.2.1
1 ml. cell culture *E. Coli*:ER2566 and 2µl were used

16.09.22 SOP0025_v01 Impact_Purification step. 8.2.2 → 8.2.3

16.09.23 SOP0025_v01 Impact_Purification step. 8.2.4 → 8.3.9

16.09.25 SOP0025_v01 Impact_Purification step. 8.4.1

16.09.25 SOP0028_v01 Bradford Protein Concentration determination

16.09.25 SOP0025_v01 Impact_Purification step. 8.4.3
All seven aliquots were pooled

16.09.27 SOP0027_v01 - MIC
MIC step. 7.2

16.09.28 SOP0027_v01 - MIC
MIC step. 7.3 → 7.9
The bacteriocin were diluted 2 fold from row A G, starting with a concentration of 15,2 µg/ml and ending at 0 µg/µl in row G

The layout of the microtiter plates were as follows:

Column:	
1	Mueller-Hinton broth
2	Mueller-Hinton broth
3	<i>S. aureus</i> :CC398
4	<i>S. aureus</i> :CC398
5	<i>S. aureus</i> :USA300

	6	<i>S. aureus</i> :USA300
	7	<i>S. aureus</i> :hVISA
	8	<i>S. aureus</i> :hVISA
	9	<i>P. aeruginosa</i> :PAO1
	10	<i>P. aeruginosa</i> :PAO1

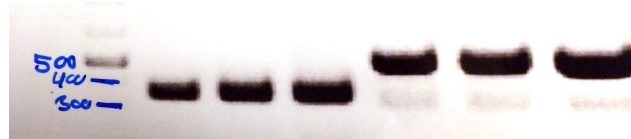
7. Sample specification.

Sample name	Sample content	From	Used for / Saved where
BR82	pSB1C3:k2018015		pPCR
BY86	K2018015 with IMPACT overhangs		IMPACT purification
BR126	<i>E. Coli</i> :K12/pTXB1	MGJ strains freezer	IMPACT vector
BY154	BY86 purified		
BG159	BY154 cut with NdeI & SapI/purified		
BR166	K2018015/pTXB1		
#101	BR166/ <i>E. Coli</i> :ER2566		-80°C Freezer

8. Remarks on setup.

9. Results and conclusions.

- The following gel image were used to verify that K2018015 were successfully cloned into pTXB1 (the IMPACT vector) We used three different primers to 'cross amplify' the gene and part of the vector plasmid, getting 2 different DNA bands, all of them were as expected. 330bp and 494 bp.



- The Bradford assay: We measured $OD_{595} = 0,05360$, together with the BSA standard curve (see appendix) we calculated a final protein concentration as being $30.4 \mu\text{g/ml}$
- The MIC assay gave the following MIC values:

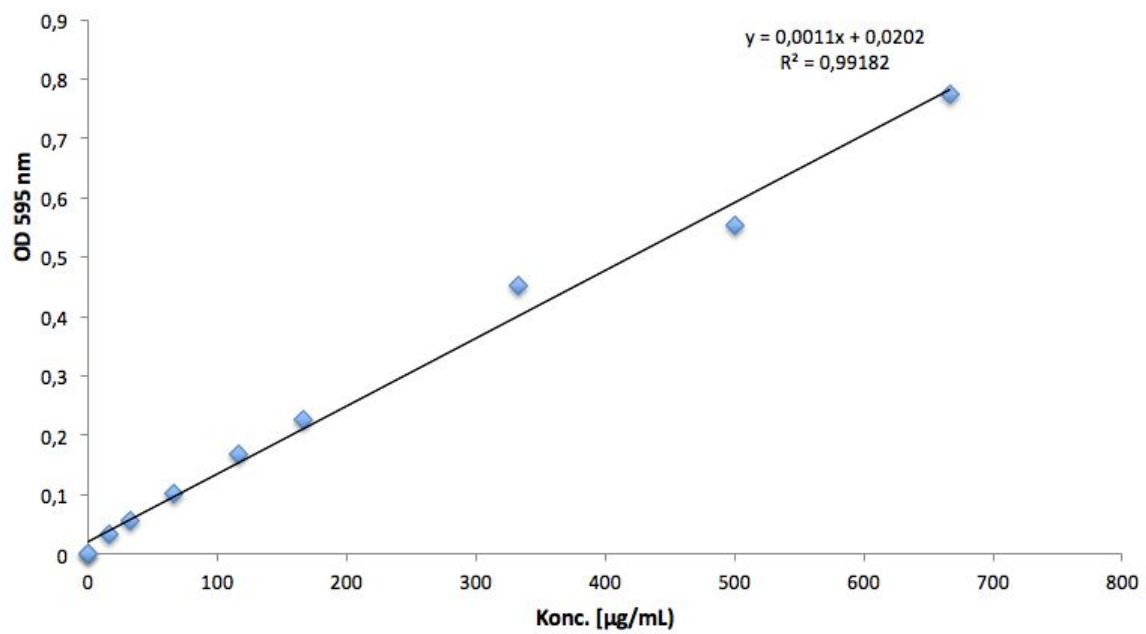
Strain	MIC ($\mu\text{g/ml}$)
<i>S. aureus</i> :CC398	7,6
<i>S. aureus</i> :USA300	7,6
<i>S. aureus</i> :hVISA	7,6
<i>P. aeruginosa</i> :PAO1	15,2

Based on the above we concluded that our bacteriocin hybrid (Lacticin Q-Lacticin Z) were successfully expressed and purified using the IMPACT system.

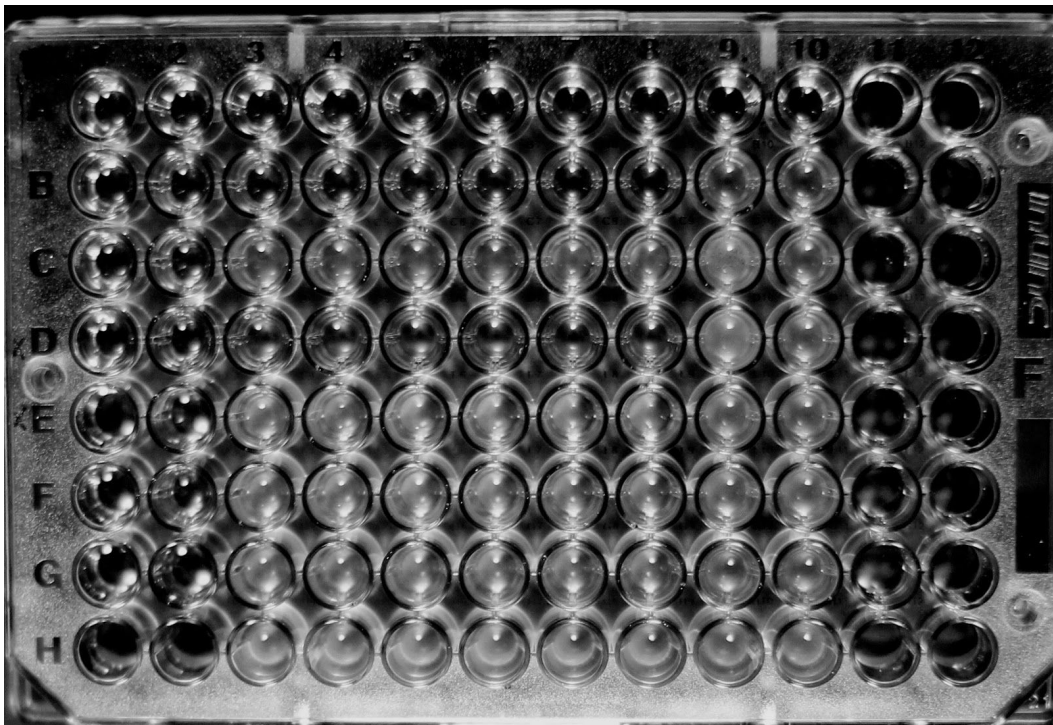
Furthermore we showed that our own hybrid design had antimicrobial effect on three multiresistant *S. aureus* strains and one resistant *P. aeruginosa* strain.

We also made a control MIC where we treated the same strains with ampicillin ($2000 \mu\text{g/ml} \rightarrow 0 \mu\text{g/ml}$) and chloramphenicol ($5000 \mu\text{g/ml} \rightarrow 0 \mu\text{g/ml}$), no strains were inhibited which confirms that the strains is resistant.

10. Appendixes



Bradford Assay standard BSA protein curve.



Microtiter plate from MIC assay with bacteriocin